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Renewable Wind Energy and Southern Illinois University

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RENEWABLE WIND ENERGY AND SOUTHERN ILLINOIS UNIVERSITY CARBONDALE

By

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A Research Paper

Submitted in Partial Fulfillment of the Requirements for the

Master of Public Administration

Department of Political Science

In the Graduate School

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RESEARCH APPROVAL

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INTRODUCTION

Can the introduction of wind turbine technology at SIUC reduce operating costs and boost SIUC's reputation?

Over the years SIUC enrollment has been decreasing, Illinois state government funding declining, and SIUC's financial position becoming a concern. SIUC has experienced its student population drop from 21,999 students in 1991 to 17,815 in 2011 (Daily Egyptian, 2011). While the student population has been decreasing so has the state supported university revenues. In fact SIU state supported funding has decreased from $247 million in 2002 to $217 million in 2012 stated Poshard (Daily Egyptian, 2012). While one solution may help aid in SIUC's financial problem, it's called wind energy.

Throughout this paper we will review the facts surrounding wind energy, wind energy and its application relating to SIUC, various comparisons from similar applications within other universities and detailed discussion breaking out the economic impact of wind energy at SIUC.

Given the proper turbine and wind characteristics wind energy might provide a long term financial solution that could reduce monthly utility costs, attract government financial grants, and aid the development of making SIUC the great university that it should be. Until recently wind energy was considered more of an exploratory or experimental energy in all, but the most ideal wind conditions. Over the last couple of years though wind turbine efficiency and power production characteristics have drastically improved creating wind turbines that can create up to five megawatt of power and harvest wind energy in slow wind applications as slow as three to five mph (AWEA.org). Previously, wind turbines could only foster around one to two megawatts of power in wind applications that were higher wind speeds.

The main benefit of new wind turbines is that they have continued in growth and size creating power output needs that benefits the user (AWEA.org). These improved wind turbine

efficiencies are the direct gain of product end users, such as SIUC. These product efficiencies translate into current and future utilities saved, thus saving SIUC money upfront and in the black. With fossil fuels on the rise and oil selling for over $100 per barrel even in a down market SIUC should capitalize on these financial savings and invest into other areas the university sees fit. SIUC can also become the tier one producer and sell back any excess power produced from the wind turbine to the local energy grid. To make wind energy more lucrative the federal government offers tax credits to help offset the high initial cost of the turbines. These lucrative tax credits called Production Tax Credit last for twenty years and cover all new wind turbine installations. With Illinois being the twelfth most windy state and Jackson county holding class three wind power SIUC has a real chance to get back on its feet with the opportunity and capitalization on renewable wind energy and the supporting market (AWEA.org).

The focus of this research and analysis is to identify whether renewable wind energy benefits SIUC. Many people think that renewable energy is always a feasible and cost effective solution because the power harvested is free. In many instances wind and other renewable energy sources are becoming more palatable, but the answer is far from a simple “yes”. Well unfortunately the answer is much more complex than this. As referenced in figure three wind turbines can cost up to ten of millions of dollars each and securing lines of credit this large can sometimes be very difficult. Although wind itself is free to harvest and very plentiful, wind and the surrounding demographics need to have supporting characteristics that make wind turbines a feasible solution. Some of the characteristics to consider are: financing, tax credits, wind characteristics, policy & political solutions, and community opinions. These characteristics in turn will help determine if a particular turbine is suitable for SIUC’s needs and if the wind turbine selected can be profitable and more importantly stimulatory for SIUC. This research

plans to analyze through literature review, methodologies, and general discussion what if any palatable solutions wind energy can provide for benefiting SIUC.

Today we know more about wind energy than ever before and manufacturers are developing wind turbines that reflect these understandings. The technology supporting the harvesting of wind power has grown leaps and bounds since its initial development. In fact in 1980 the average size wind turbine had a power rating of about twenty-five KWh, today the average wind turbine has a power rating of about 5000 KWh or 5MW (AWEA.org). Some of the key large scale wind turbine manufacturers are: Vestas, Siemens, Gamesa, Mitsubushi Heavy Industries, Suzlon, Clipper Windpower, Nordex, and the world's largest company GE. These companies continue to push the envelope and with little doubt will continue the push for more reliance on renewable wind energy in the future. Some of the smaller wind turbines manufacturers include: Proven Energy, Bergey, Southwest Windpower, and Enertech. The focus is not to educate one on all aspects of the wind energy industry, but provide a basic high level overview of what wind manufacturers are available, the range of wind turbine applications, and the states with the most wind energy available & in use.

LITERATURE REVIEW

As technology continues to evolve wind energy has grown to the forefront of alternative renewable energy. Wind energy has several energy providing competitors that have already established themselves within the power industry. As part of the research we will be touching base on solar and coal from time to time. When considering technology and power options it always critical to understand the effects and benefits of each option but, this can often be difficult to measure so establishing a baseline or measure of just staying the course is usually a great target point. In the case of adopting wind energy at SIUC simply staying the course might be viable as the capital requirements for purchasing a wind turbine at SIUC is in the neighborhood of $6.5 to $7.5 million dollars (TheSouthern.com, 2011). On the other hand other energy options tend cost more. For instance a clean coal power plant of twenty-three megawatts almost came to light at SIUC nearly a decade ago but, was scrapped due to high upfront cost of $54 million dollars (SIUC News, 2002). Solar has a similar model of wind energy upfront costs but, a much higher operating cost. For instance solar energy costs over twenty cents per kWh (AWEA, 2007). This is far higher than the current six cents per kWh that SIUC is currently purchasing from the local power provider. The current financial situation within SIUC is delicate and tuition rates continue to climb. The research does not support the notion that staying the course is the best option on return on financial investment but, does prove to be viable in the fact that until the wind turbine is paid off it is a long term investment with high upfront capital costs. Additionally, there might be other high impact projects that require less capital with quicker return on investment scenarios. This could mean that although the numbers of wind energy for SIUC make sense other projects make more sense. Since cash is critical today for SIUC then maybe staying as financially liquid might be a strong option but, more information of this subject can be reviewed within the cost analysis portion of this research. Additionally waiting to

implement wind energy at SIUC could allow for further improvements with wind energy technology and might prove to be an option as wind technology is likely to continue to improve in terms of efficiency and cost in terms of value. For instance wind turbines have "doubled their efficiency in the last six years" (AWEA, 2007). Another aspect of waiting to consider is the predicted cost of energy over time or hedging. Historically just like inflation and commodities the longer the time and the more depleted a particular resource the more likely the cost of the item will increase. This is not in favor of waiting but, the economy as a whole is in a recession meaning that pricing for energy could remain relatively affordable and flat but, this is an unpredictable circumstance and would likely be based on an educated guess and not sound fact. Overall, if proven that enough wind is available wind energy is a more viable long term solution for SIUC provided that they have the financial resources to survive the short term as well.

SIUC is at the forefront of possibly integrating this technology into the university but, four other colleges and universities have already integrated wind energy technology within their facilities at similar to larger scales (SIUC is 2.5 megawatt). These colleges and universities include: Whitman colleges (37 megawatts), Mount Wachusett Community College (3.3 megawatts), University of Minnesota (2.3 megawatts), and University of Delaware (2 megawatts) (AASHE, 2012). Additionally, there are over seventy additional college and universities that currently embrace wind energy technology but, in a smaller scale of 1.6 megawatts or less (AASHE, 2012). Among these seventy additional smaller scale wind turbine embraced universities is none other than Southern Illinois University Edwardsville. SIUC could embrace this wind turbine technology at SIUC and promote the fact that they are a green energy university with multiple wind turbines. The point being addressed is that many universities have tried wind energy technology with success. Wind energy for the masses is a relatively new

technology but, nearly seventy-five universities across the United States have been able to justify the expense of wind turbine technology. Overall, wind turbine technology is a growing power solution for universities across the United States.

While wind energy is a growing renewable energy it too has obstacles to overcome. Most potential failures of wind turbine technology stem from: wind turbine reliability, preventative maintenance cost overtime, viability of tax credits for years to come, sizing of wind turbine to application, and green building practices of the wind turbines. Wind turbines are very reliable with only sixty-eight wind turbine accidents recorded in 2008 (Building Green, 2012). This is far less than one percent in relation to the 656,000 wind turbines installed globally (World Wide Wind Energy Association, 2012). This means that the notions of wind turbines being unreliable is largely unproven as any product with less than a one percent failure rate should be deemed very reliable. Wind energy preventative maintenance costs overtime might become significant like any aging product but, this new era of super large two megawatt wind turbines. These turbines are geared for thirty plus year lifespans and minimal maintenance. Simply reviewing past information on previous wind turbines is not accurate as prior wind turbines were built to different standards. No research supports that these new wind turbines are going to become pricey towards the rear of their lifecycle but, no one really knows until these products reach their life expectancy. Tax credits for wind energy is very similar in the essence that no one knows the availability of energy credits for wind energy in the future. This could be a failure for wind energy as tax credits were critical to the growth of the wind energy technology through the 2000's but, as new energy technology is continually being created and no certainty of available funds by the federal government no one knows for certain if in the future there will be any available tax credits for wind energy technology. Site sizing applications and construction

techniques can be failures of wind energy as well. More specifically modern wind turbines are an amazing technology but, there are still many applications that have fixed site specifics that make wind turbine technology not fitting for the particular applications. One instance of this includes installing a wind turbine in location that has high installation costs and diminishes the return of investment of the wind turbine. Another instance might be installing or sizing the wrong turbine for the job. Not correctly analyzing the available wind data and selecting the correct type of turbine could diminish the return on the investment but, even worse not produce the necessary power the university needs to be more self-reliant. Overall, wind turbine technology if managed properly can be a successful and helpful technology but, if details are not reviewed it leaves the possibility for failure just like any other product.

METHODOLOGY

Wind energy technology can be very helpful to SIUC as long as the necessary wind is available and the financial return on investment is cost effective. The true understanding of wind energy available is still currently being measured by SIUC engineers and more information should be available in the future. The initial investment of the proposed wind turbine at SIUC is expected to cost between $6.5-$7.5 million dollars (TheSouthern.com, 2011). Additional financial information and key facts about the wind energy project as it relates to SIUC can be found in figures one through four. In addition if SIUC where to have the proposed wind turbine installed prior to the end of and take advantage of the current two point two cents per kWh federal wind energy tax credit. This current tax credit would create an estimated annual tax savings of $484,000.00, please see figure one for more information. This tax credit is really what creates the tipping point of making wind energy lucrative as it really helps offset some of the capital costs of the wind turbine. This credit is good for two point two cents per kWh of any power produced from the wind turbine for twenty years. This helps dramatically in shaping a competitive cost analysis for wind energy. As the data shows in figure three if the wind turbine can produce anywhere near the annual 22 million kWh then wind energy makes money for SIUC. In figure three you can see the SIUC $13 million + wind energy savings graphed out over the estimated life of the wind turbine and figure four shows the yearly and lifetime savings of the wind turbine at SIUC. This is probably understating the savings associated with wind energy technology because this formula assumes that the energy that SIUC is buying will stay fixed at the price point of $.0634 cent per kWh for the next thirty years. Energy costs are always rising and it's fairly safe to state that future energy costs will continue to rise over the long term. Please reference figures one through four on pages three, four, and five to get a more in depth understanding of the wind energy savings applied to SIUC

but, the main points of importance are $13.543 million in reduced costs for the next thirty years, five point seven percent reduction in energy spend costs, and an equivalency to one point seven years of free electrical power to the university.

Wind energy will stimulate SIUC far beyond the reduction of greenhouse gases and making the world a better place. In addition to greenhouse gas reduction wind energy at SIUC can help: increase cash flow, level out cash flow for future years, drive long term sustainment of SIUC, and provide a new public image. SIUC after years of declining enrollment, and reduced support from state funds could benefit from this much needed stimulation. Wind energy will help stimulate SIUC by improving cash flow through reducing total costs. As reviewed above wind energy makes sense for SIUC creating a cost savings for SIUC because their reduced total energy costs are greater than the cost of the wind turbine. This creates a surplus of cash or increased monthly income that is now available for other purchases. Wind energy and the cost savings it provides SIUC can help keep SIUC competitive to the new generation of private and online universities. Many universities are trying very hard to keep costs low so students can afford to go college. Wasting power simply by not adopting to newer technologies is lost revenue or savings the university could benefit from. Using a wind turbine at SIUC could also help level cash flow out as the university could safely predict their reoccurring energy costs. Currently, energy prices are negotiated and locked for an extended period of time. This can be beneficial for some such as Southwest airlines who locked in an extended fuel price contract and shortly following fuel prices skyrocketed. Adopting wind technology can avoid the guessing market game and rest assured that their energy rates are competitive regardless of the economy. The wind still blows the same regardless of a recession or booming market. Wind energy also has the ability to shape the image of SIUC to something truly positive. After years

of the “party school” image SIUC has made dramatic strides in improving its image and providing new first rate offerings such as: recreation center, health center, university housing, football stadium, face lifted basketball arena, and library to name a few. In conjunction with these new facilities SIUC could embrace wind technology and provide students with competitive university offerings from new facilities, green technology, and competitive costs. It’s likely that enrollment will increase shortly following.

DISCUSSION

The purpose or use of this evaluation is to gain better insight on why wind turbine technology is right for SIUC. SIUC should be able to accurately decipher the strengths and weaknesses associated with wind energy technology and how integrating wind technology into SIUC could improve their long term financial picture. The strengths of wind turbine technology and how they apply to SIUC were thoroughly reviewed through cost analysis, literature review, and the methodologies portion of this research. Some other strengths of consideration are what other similar situations can be taken away from this? Are there other buried cost drivers within the university cost structure that could benefit from technological innovation or refinement? Overall, this evaluation should help SIUC gain a very detailed financial insight as to why wind turbines make sense for SIUC.

While there are many benefits of wind energy there are some arguments or limitations that are worth considering as part of the discussion. Wind energy for the most part is a new emerging power option. Wind energy technology has been around for a while but, wind energy for the mass market energy supply in the United States is new. Some of the limitations of wind energy probably have not even been fully discovered due to the relative youth of the wind energy market but, some of the established limitations reviewed are: climate, geography, finances, energy analysis, political and public audience. All these limitations are critical in the success and failure of wind energy. If managed and mitigated correctly these limitations can become non critical to the success of a particular wind energy project but, not reviewed can be the demise in wind energy supporting a particular project.

The surrounding environment of the wind turbine is nearly as critical as the wind turbine itself. Without the proper site location and necessary wind the wind turbine can become useless. For instance Illinois is the sixteenth largest wind energy provider in the Unites States (AWEA,

2012) but, there are many locations within Illinois that have low classifications of wind speed making them not ideal for wind turbine technology. The wind turbine site location can also play a large part in limiting the success of the wind turbine due to construction techniques and resources needed to complete the project. Putting a wind turbine on a hill or mountain side might be suitable for capturing decent amounts of wind speed but, construction costs could be very high due the difficulty of transporting goods to the construction site, materials needed to create a mountainside footing stable enough to house the wind turbine, and advanced site preparation making the wind turbine fit properly into the location. Another detail due consider might be access to the existing power grid. If the wind turbine location is up in a mountain or in an uninhabited location it is not likely that an existing power grid is present. This means the infrastructure necessary to support the wind turbines power will need to be expanded to the job site thus increasing costs. As reviewed site specific climate and geography can easily limit the success of wind turbine technology.

In most case financing is a huge benefit especially when dealing with applications such as expensive as a wind turbine at SIUC that is expected to cost in the range of $6.5-$7.5 million dollars but, this might be a limiting factor for SIUC. SIUC and the State of Illinois are in huge amounts of debt making it nearly impossible for them to pay for the wind turbine with cash and even more difficult for them to receive financing needed to finance the wind turbine over the long term. Currently the State of Illinois is in $11.6 billion dollars of debt, the state's largest debt ever (Senate GOP, 2012). In addition to the high levels of debt the State of Illinois currently has the lowest level of credit rating in its history (Senate GOP, 2012). When comparing the State of Illinois credit rating to neighboring state's it also has the lowest credit

rating as well. As reviewed financing might be the lynch pin of SIUC adopting wind turbine technology.

The energy analysis is key to the success of the wind turbine at SIUC. This is also a limiting factor because if the energy analysis that is still pending review from SIUC engineers comes back and determines that available wind is minimal and there currently are no wind turbines in the market place that can support it then wind energy will not be viable for SIUC at that time. The energy analysis is only a limiting factor until technology progresses to the point that the available wind energy can be successfully and efficiently be harnessed as wind data suggests that SIUC geographically falls into a class three wind area meaning that parts of SIUC has harvestable wind (AWEA, 2012).

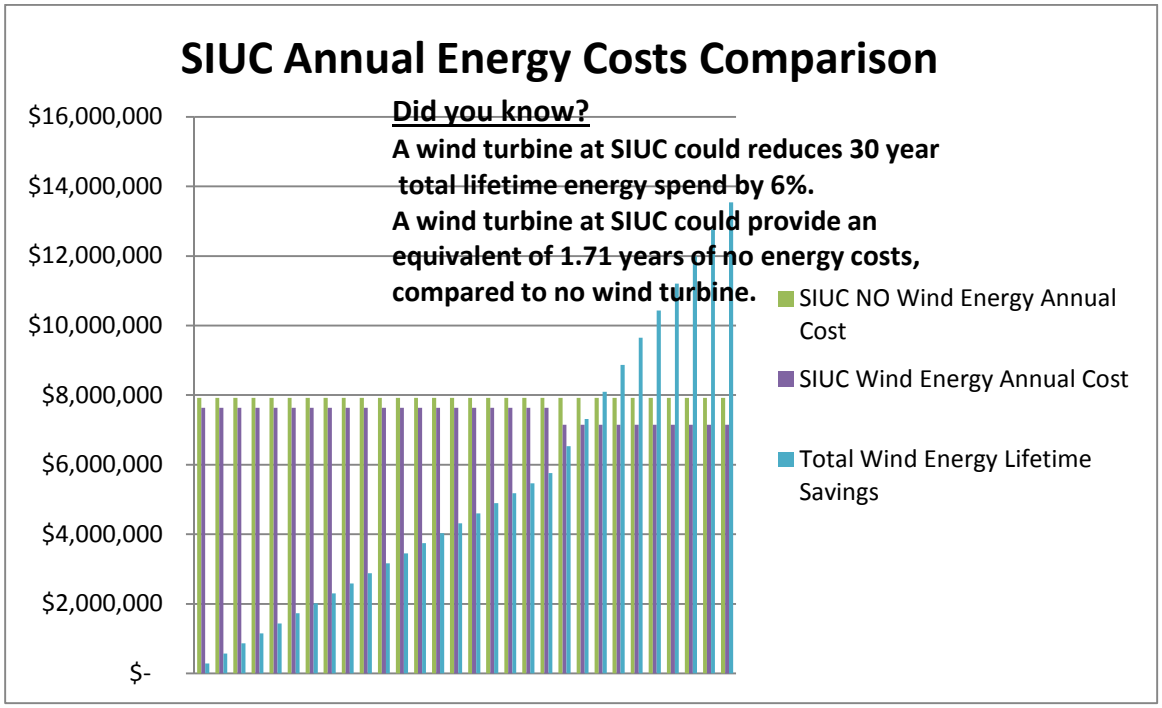
The wind energy audience is primarily comprised of two groups: public and political audiences. As wind energy is an emerging technology the audience base plays a large role in shaping success of the project as the technology is unfamiliar. The public audience has the ability to ensure that harmful products are not integrated into their society. In the case of wind turbines the wind turbines have been deemed very safe but, in a few cases have self-destructed creating airborne particles. This could be a safety hazard if this was to occur anywhere near the SIUC campus itself. The public audience also has the ability to review the safety of the product in terms of how it affects animals and the environment. While environmentally wind turbines are renewable technology so it is helpful for the environment. On the other hand wind turbines have been known to kill approximately one hundred and fifty thousand birds annually (The Washington Post, 2011). The number of birds killed by wind turbine is still far less than the 500 million birds killed annually by cats (The Washington Post, 2011). The political audience has the ability to truly embrace or discount the value wind energy technology can help shape SIUC and

the State of Illinois. Currently, federal tax credits have stimulated this relationship to exist but, the State of Illinois has done little to support wind energy. This may be in case point that the State of Illinois has little available funds and federal tax credits were already supporting the adaption of wind energy. The political audience also has the ability to adopt the wind energy and renewable energy for that matter as part of their "political agenda" or tasks that they think are a priority but, this will largely be driven by the public audience. Overall, both the political and public audience base have the ability to derail the success of wind energy at SIUC but, likely won't as the both parties continue to expand their knowledge and understand the benefits of wind energy technology.

CONCLUSION

Will wind energy end up at the fore front for SIUC, only time will truly tell? One thing is for certain though and that is that many of the verticals needed for wind energy at SIUC to succeed are present. Will the verticals align “hopefully” but, again time and surrounding economic conditions will likely have a huge impact of whether or not the SIUC wind energy project will ultimately come to life. With the new area or restructuring government spending and reform this project has a good chance of succeeding because of the investments positive long term payback and its strong business case offerings. On the other hand the State of Illinois and SIUC credit ratings and debt continue to be a worrisome factor. The SIUC wind energy project could simply be derailed to a poor credit score or simply not enough available funding for the project to even come to life. Another vertical worth pursing might be the expansion and possible venture for a public private partnership or lease relationship. Joint relationships are gaining popularity within the market place as long as both parties have something beneficial being brought to the market place. In this situation a joint relationship might be beneficial if SIUC could provide the land and opportunity and the private partner could provide the needed capital on interest or wind turbine on lease. More importantly though I think the verticals present far outweigh the negatives and given time with further refinement in technology, a recovering market with potential for new market growth, incredibly low interest rates, rising energy price per Kwh, recent fines and required improvements to the dated coal infrastructure, wind energy will only become more lucrative. The best question that should truly be asked is when SIUC will adopt wind turbine technology.

TABLE


SIUC Annual Energy Costs Comparison
Did you know?
A wind turbine at SIUC could reduces 30 year total lifetime energy spend by 6%.
A wind turbine at SIUC could provide an equivalent of 1.71 years of no energy costs, compared to no wind turbine.
$16,000,000
$14,000,000
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$-
SIUC NO Wind Energy Annual Cost
SIUC Wind Energy Annual Cost
Total Wind Energy Lifetime Savings

FIGURES

Figure 1

Cost Analysis		
	SIUC Wind Energy	**SIUC No Wind Energy**
Wind Energy Annual Cost	$ 1,100,000.00	$ -
SIUC Energy Annual Cost	$ 6,530,200.00	$ 7,925,000.00
Wind Energy Annual Tax Credit	$ 484,000.0000	$ -
Wind Turbine Annual Cost	($491,007.07)	$ -
Estimated Annual Costs (Wind Turbine Loan)	**$ 7,637,207.0700**	**$ 7,925,000.00**
Estimated Annual Savings (Wind turbine Loan)	**$ 287,792.9300**	**$ -**
Estimated 20 Yr. Savings(Wind Turbine Loan)	**$ 5,755,858.6005**	**$ -**
Estimated 10 Yr. Savings (No Wind Turbine Loan)	**$ 7,788,000.0000**	**$ -**
Estimated 30 Yr. Total Savings	**$ 13,543,858.6005**	**$ -**

Figure 2

Key Facts		
Category	**Measure**	**Metric**
Wind Turbine	Wind Turbine Estimated Cost	$6,200,000.00
	Wind Turbine Loan Term (mo)	240
	Wind Turbine Estimated APR	5%
	Wind Turbine Annual Output (kWh)	22,000,000.00
Energy Costs	Wind Energy Estimated Cost per kWh	$ 0.0500
	SIUC Energy Estimated Cost per kWh	$ 0.0634
	Tax Credit for Wind Energy per kWh	$ 0.0220
SIUC	SIUC Annual Energy Output (kWh)	125,000,000.00

Figure 3

Year	1	5	10	15	20	25	30	Totals
SIUC Wind Energy Cost	$ 7,637,207	$ 38,186,035	$ 76,372,071	$ 114,558,106	$ 152,744,141	$ 188,510,177	$ 224,276,212	$ 224,276,212
SIUC No Wind Energy Cost	$ 7,925,000	$ 39,625,000	$ 79,250,000	$ 118,875,000	$ 158,500,000	$ 198,125,000	$ 237,750,000	$ 237,750,000
Total Combined Savings	**$ 287,793**	**$ 1,438,965**	**$ 2,877,929**	**$ 4,316,894**	**$ 5,755,859**	**$ 9,614,823**	**$ 13,473,788**	**$ 13,473,788**

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